Based on Multiple Linear Regression Model, Analyze the Influencing Factors of New Energy Vehicle Stock

Jinyi Zha

***Abstract*—With the public's awareness of environmental protection, new energy vehicles have been favored by more and more consumers. However, in the development process of new energy, in fact, there are risks caused by the fluctuation of many influencing factors. Therefore, how to formulate reasonable technological development routes and market strategies according to China's actual situation and combined with the characteristics of new energy vehicle technology, so increase international competitiveness and increase stock market value has become an important topic for the development of China's new energy vehicle industry. First, this paper combines domestic and foreign representative companies of the new energy vehicle industry to analyze the industry status quo. Secondly, it analyzes the strategic environment for the development of new energy automobile industry. In the process of research, the influence hypothesis of China Consumer Price Index (CPI), Exchange rate (USD-CNY) and the company's net profit on the company's stock price was put forward. Taking Tesla, BYD and NIO as examples, SPSS software was used to analyze the data from January 2021 to October 2022. Multiple linear regression analysis was conducted by using China CPI, Exchange rate (USD-CNY) and the company's net profit as independent variables. The hypothesis is proved and disproved by BETA coefficient, and the influence of three variables on the company's stock price and its reasons are analyzed. Finally, it puts forward some policy suggestions to enhance the international competitiveness of the new-energy automobile industry.**

***Index Terms*—New energy vehicles, multiple linear regression model, consumer price index, exchange rate, net profit**

I. Introduction

Cars have been widely embedded in the daily life of Chinese people for 15–20 years. The rapid development of China's automobile industry is very fast, by 2009 has become the world's first production and sales power. However, with the gradual exposure of the trend of non-renewable energy shortage and the increasingly serious side effects of global environmental pollution, governments are encouraged to strengthen policies and regulations to protect the environment. The automobile industry is facing the transformation and upgrading of the industry. New energy vehicles have become the backbone of the transformation and upgrading of the automobile industry. More and more car manufacturers, such as BYD, SAIC, etc., are involved in the field of new energy vehicles. Internet companies Baidu and Xiaomi have also invested in new energy vehicles. Huawei, a leading enterprise in China's information and communication industry, invests about ten billion yuan every year in the field of new energy vehicles. By taking advantage of its technological advantages, Huawei has independently developed key components of new energy vehicles, such as brake system, car-size automotive chip, AR-HUD, and high-voltage fast charging technology for automobiles. Accelerating the cultivation and development of new energy vehicles can not only alleviate the predicament of energy shortage, but also accelerate the transformation and upgrading of the automobile industry and respond to the national strategic deployment.

Compared with traditional cars, new energy vehicles have many advantages: First, new energy vehicles help to save energy and reduce emissions. The carbon emission of new energy vehicles is about 50% of that of traditional cars. China emits about 120 million tons of automobile exhaust every year, accounting for about 85 percent of air pollution. Energy conservation and emission reduction will undoubtedly contribute to the rise of China's new energy industry, and the green development of China's automobile industry is an essential element to ensure energy security. Second, the national policy support for new energy vehicles is very strong, the purchase of a new energy vehicle can enjoy 5000–13000 financial subsidies. In 2021, the number of new-energy vehicles reached 7.84 million, of which 6.4 million were pure electric vehicles, accounting for 81.63 percent of the total number of new-energy vehicles. Third, the new energy vehicle market is increasingly rich in available products, covering the high, middle, and low segments, which can meet the consumer needs of different income groups.

However, there are still many problems with new energy vehicles: First, the development of charging infrastructure is not perfect. The quantity and distribution of charging infrastructure will affect the convenience of charging electric vehicles. If the charging cannot be extended in time, the driving range of electric vehicles will be limited, which will cause great trouble to consumers. Second, the range of electric cars is short. At present, the comprehensive endurance of the mass-produced electric vehicles is only about 400km, which cannot meet the long-distance needs of users. Third, the battery of new energy vehicles is greatly affected by the season and temperature. Under the condition of low temperature, the battery's own charge and discharge power are attenuated, which has a 10% impact on the range. At the same time, if the heating and air conditioning is turned on in the car under low temperature conditions, an electric vehicle with a power consumption of 13 degrees for 100 kilometers will consume 13 degrees for 100 kilometers at the speed of 30km/h, so that the mileage can only reach half of the normal temperature condition. Only by facing up to and solving problems, new energy vehicles can be favored by more potential customers.

Manuscript received February 16, 2023; revised March 24, 2023; accepted April 6, 2023.

Jinyi Zha is with the Cambridge International Exam Centre in Shanghai Experimental School, Shanghai Municipality, CO 201210 China. E-mail: christinajinyi@163.com.

doi:10.18178/joebm.2023.11.2.740

II. Literature Review

A. Machine Learning Model for Stock Return Forecast Technical Route

Stock market prediction has always been a hot topic in financial circles. Accurate prediction plays a crucial role in investors' analysis and decision-making. Many empirical studies show that machine learning plays a significant role in stock return rate prediction. Initial stock market data were predicted with Autoregressive Integrated Moving Average (ARIMA), a time series model proposed by Box and Jenkins (1990). But this model is not suitable for nonlinear dynamic data. At present, prominent methods in data mining are linear regression, logistic regression of Pai and Lin (2005) and Support Vector Machine (SVM) of Abirami and Vijaya (2012). Naturally, these methods are also popular ways to forecast the stock market. For example, Phua and Zhu *et al*. (2003) conducted a study to predict the trend of five major stock indexes with a prediction accuracy higher than 60% by building a neural network model. Zhang and Chu *et al.* (2020) proposed a two-stage machine learning method, SCR-EnanFIS, to predict stock prices. After comparing the prediction of four stocks in Shenzhen Stock Exchange, they found that the two-stage machine learning method proposed by them had higher prediction accuracy than the single ENANFIS method. Huang and Nakamori *et al.* (2005) tried to use support vector machine (SVM) to predict the weekly trend of Japan's Nikkei 225 Index. The results show that the support vector machine and the combined model of support vector machine can reach the hit rate of 73% and 75% respectively. Pai and Lin (2005) proposed the method of combining ARIMA and SVM, so that the combination of linear and nonlinear can be used achieved to predict the stock market data with changeable patterns.

B. Green Growth Theory and Industrial Subsidy policy

As a green and environmental protection emerging industry, the new energy automobile industry needs to develop sustainable development strategies to extend the life cycle of the industry compared with the traditional industry. The government's financial subsidies also have different impacts on the industry.

C. Sustainable Development Strategy

In the face of the increasingly serious global energy problems and environmental crisis, WIPO (2009) launched the millennium development plan and clearly put forward the environmental sustainable development strategy to ensure energy security and green growth. New energy vehicles have become one of the important projects.

Among them, low-carbon transportation can ensure the market environment for green growth, and ultimately achieve the goal of sustainable development. Su (2010) believes that the purpose of low-carbon transportation is to save energy and reduce emissions, improve transportation efficiency and optimize transportation structure by using systematic regulation and green technology, and realize the transformation from the existing economic society to a low-carbon society.

According to the research of Pew Foundation (2010) Walet, from 2005 to 2009, the United States, the European Union, Japan, China, and other countries developed rapidly in clean energy investment and innovation, and accordingly adjusted their national energy strategies and policies. In the United States, the Obama administration formulated the Clean Energy and Security Act (2009) to define the national strategic deployment for the development of clean energy. In 2011, it proposed to the Congress a strategic plan to shift the focus of emission reduction to new energy (Science, 2011).

D. The Impact of Government Financial Subsidies

Due to the fact that the construction of ecological civilization has been put in an important position; the government subsidy has played an important role in the development of our new energy automobile industry. It is generally believed that the influence of government subsidies on enterprise R&D investment can be divided into two categories: promotion effect and substitution effect.

The first promoting effect is that government subsidies have a positive promoting effect on enterprises' R&D investment. From the perspective of the energy industry, Lee (1996) believes that government financial subsidies and enterprises' R&D input are positively correlated, that is, the increase of government subsidies can promote enterprises' R&D input. Hasishi (2007) affirms the promoting effect of government subsidies on enterprises' R&D input, and if other conditions remain unchanged, the promotion effect of government subsidies on the field of technology application is more significant, but the promotion effect on the field of technology extrusion is weaker.

The second kind of substitution effect, that is, government subsidies have a negative inhibitory effect on enterprises' R&D investment. Lichteberg (1987) believed that the previous model studying the impact of government subsidies on enterprise R&D input had a setting defect. He set government subsidies as endogenous variable and found that government subsidies had a significant negative substitution effect on enterprise R&D input.

However, many scholars question the effectiveness of industrial subsidy policies. Warwick (2013) believes that due to the different interests of various groups, information asymmetry and other factors, it is difficult to timely launch market economy when industrial policies are damaged, which will result in long- term dependence of enterprises on policy subsidies.

By investigating the development status of different new energy vehicles at home and abroad and different evaluation methods of international competitiveness, the international competitiveness of China's new energy industry is analyzed.

E. Technology Development Status

Liu and Kokko (2013) believe that the development strategy of Chinese new energy vehicles can be divided into three stages. The first stage is from 2001 to 2009, China launched the 863 program "Energy Saving and new energy vehicle Major project", providing 2 billion funds to carry out the research and development of electric vehicles, fuel cell vehicles and hybrid electric vehicles; The second stage is 2009-2010, to guide the promotion and application of hybrid electric vehicles and pure electric vehicles in public transport; The third stage was the introduction of the consumption subsidy system for plug-in hybrid electric vehicles and electric vehicles after 2011.

Zeng and Shi (2011) made a comparative analysis of the

development strategies of domestic and foreign new energy automobile industries and believed that China should integrate the upstream and downstream of the new energy automobile industry as soon as possible to form a complete industrial chain, reflecting the value chain and supply chain of pure electric vehicles according to the industrial chain. Yang (2011) believed that the main obstacles to the development of China's new energy automobile industry were mainly reflected in capital, personnel, infrastructure construction and productization capacity. Wan and Spring *et al*. (2015) analyzed the plight of electric vehicles in China and summarized the main reasons for unfavorable sales of Plug-in Electric Vehicles (PEV) as protectionism of local government, uncertainty of electric vehicle technology in promotion, lagging investment in charging facilities and conservative investment of automobile manufacturers and battery manufacturers.

The endurance capacity of new energy vehicles is one of the important factors for many potential consumers to consider whether to buy their vehicles. New energy vehicles with long battery life are more likely to be favored by consumers. Sitenecker (2005) studied supercapacitors and battery energy storage systems in new-energy vehicle batteries and proposed a new circuit composition mode for the combined use of supercapacitors and batteries, aiming to effectively improve the service life of batteries. However, cost has become a bottleneck in the implementation and application of this type of circuit combination. Oltra and Jean (2009) studied the global patent data of low emission technologies for vehicles from 1990 to 2005 and concluded that most automobile manufacturers in different countries implemented differentiated positioning strategies based on the diversity of automobile technologies and development prospects.

In addition, the rationality and convenience of the distribution of charging piles are closely related to the use experience of drivers and passengers. Li and Jia (2013) conducted field investigations on charging stations and built a benefit model for the economic development of charging stations based on the profit and loss theory. Morrow and Karmer *et al.* (2008) believe that there are differences in charging demand in different regions, which should be analyzed and studied by comprehensive comparison. Wynne (2009) pointed out that the daily average electric load of electric vehicles is an important factor affecting the charging demand, and it needs to be analyzed emphatically.

F. Industrial International Competitiveness Model

With the development of The Times, technological innovation, as a complex process, has a more and more significant impact on the development of a country, and the government, as a new entity, is taking an increasing proportion in technological innovation. Porter (1990) connected the micro mechanism of national innovation with the macro-operation practice, investigated the national innovation system under the background of economic globalization, and put forward the "diamond model" of the theory of "national competitive advantage". Andrew and Malik (2014) modified the "International Diamond Model" to maximize the impact of "corporate strategic planning" on competitiveness. At the same time, domestic scholars have also improved and perfected the "diamond model" for more effectively analyze the international competitiveness level of some Chinese industries. Jin (1996) pointed out that the evaluation of the international competitiveness of a country's industry should be based on the country's economic level, rather than directly using the "diamond model". Gao and Shang (2017) added the factor of "innovation" into the classic "Porter's Diamond Model" and pointed out the advantages and disadvantages of China's high-speed rail industry at the present stage in their analysis and research on the investment competitiveness of China's high-speed rail industry in Central and Eastern Europe, which provided great help for investment decisions.

G. The Behavioral Factors That Influence Market Indexes

There are also behavioral factors that affect market indexes, such as the decisions of different types of investors, and the ways of marketing of different companies.

Some natural investors tend to enter the stock market after the arrival of a bull market, and most of them have no investment experience. They tend to refer to the comments of stock market commentators to invest, influenced by outside opinions is more obvious. Polk and Sapienza *et al*. (2004) studied the relationship between investor sentiment and market index volatility and found the influence of investor sentiment on market index correlation. Zhang and Fuehres *et al.* (2011) found that the higher the proportion of comments containing emotions in the total number of financial and economic channels, the more negative the comments will be reflected in the index.

Krupa *et al.* made a detailed overview of the development prospect and significance of hybrid electric vehicles in Japan while studying the development trend of hybrid electric vehicles in Japan and put forward suggestions on the marketing methods of new energy vehicles that are different from traditional vehicles. It is necessary to formulate appropriate marketing strategies based on the behavioral characteristics of consumers of new energy vehicles.

III. Industry Status Research

A. Current Situation of the New Energy Vehicle Industry

In recent years, China's demand for crude oil has been increasing. In addition to self-sufficiency, China needs to import a large amount of crude oil every year to meet its domestic needs. In 2021, China produced about 199 million tons of crude oil and imported 513 million tons, far more than domestic production. In 2019, China's dependence on foreign crude oil exceeded 70 percent, far exceeding the international warning line of 50 percent. In this context, the development of electric energy, hydrogen energy and other new energy has risen to the height of the national strategy. Therefore, to meet the needs of environmental protection and oil crisis, China has actively promulgated policies related to new energy vehicles, encouraged the use of new energy vehicles, and advocated reducing the burning of traditional gasoline or diesel vehicles.

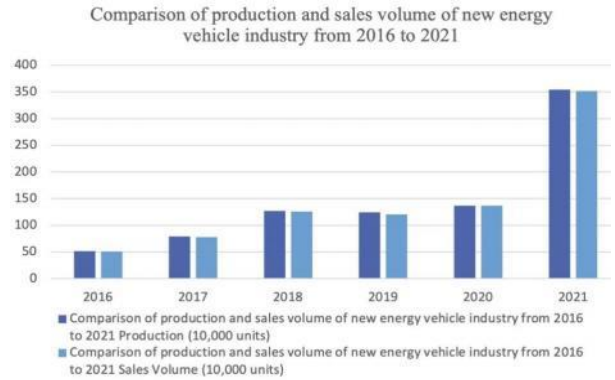

Fig. 1. Comparison of production and sales volume of new energy vehicle industry from 2016 to 2021.

Comparing the data of China's NEV market between 2016 and 2021 in Fig. 1, it can be found that its output has changed from a steady growth from 2016 to 2020 to a super-fast growth from 2020 to 2021. This also shows that the overall scale of China's new energy vehicle market shows a rapid growth state. According to statistics, China's new energy vehicle market size in 2021 is six hundred billion dollars, with a year-on-year growth of 76.5%.

B. The Development Prospect of New Energy Vehicles

The development prospect of the new energy vehicle industry can be seen through the change of the product market size and the technological progress and development of the product.

C. Changes in the Size of the Market

In the past two years, the international oil price has risen significantly, the country will continue to vigorously support and encourage the investment and application of new energy vehicles. New energy vehicles are not only the continuation and expansion of the traditional automobile industry, but also one of the important national strategies. Developing new energy vehicles is an important measure to solve the contradiction between energy and economic development. Therefore, our new energy vehicle market will continue to improve in the future.

Not only that, China's carbon dioxide emissions also have grown rapidly to become the country's largest. Compared with traditional vehicles, new energy vehicles can realize no exhaust emissions and no environmental pollution. Therefore, with the continuous strengthening of national environmental awareness, new energy vehicles will win the favor of more consumers. This keeps the market growing.

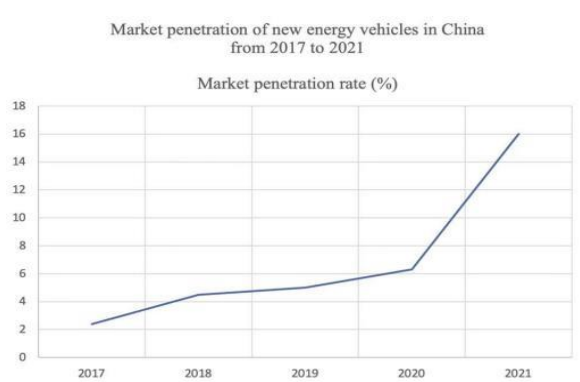

Fig. 2. Market penetration of new energy vehicles in China from 2017 to 2021.

In 2021, with the support of China's national policies, the products of new energy vehicles have been diversified and the technology has made progress. More and more users are opting for gradual acceptance. China's new energy vehicles rapidly broke out in 2021, and the market penetration rate increased significantly compared with 2017 (Fig. 2).

It can be seen that the market penetration rate of China's new energy vehicles in 2021 increased by 9.7 percentage points compared with that in 2020. However, the growth rate of China's new energy market in the next few years is likely to slow compared with the market size growth rate in 2021.

D. Product Development

In 2016, only a few levels of new energy vehicles were on sale in China, and the options for each level were extremely limited. However, by 2021, the industry products have realized the coverage of all models, and each class has a large choice space. In the future, our new energy vehicles will continue to be diversified development as the goal. With the increase of models released by manufacturers, the levels are also increasingly rich, which can serve the needs of users of different income levels.

In addition, industry competition will intensify in the future. According to the changes of market subsidy policies from 2020 to 2022, subsidies for new energy vehicles will be gradually reduced and eventually cancelled. The removal of subsidies signals that the industry will move towards market development. The elimination of state subsidies can promote the development of the market survival of the fittest and form healthy competition. Therefore, in the future, the vitality of our new energy vehicle market will continue to be stimulated, the industry competition will become more and more fierce, the truly skilled enterprises will gain a larger market share, and some enterprises with low competitiveness will be mergers and acquisitions or even eliminated by the market.

IV. Enterprise Analysis and Comparison

A. A Study on New Energy Vehicle Leading Enterprises

In 2021, EVO bserver selected 20 new energy vehicle companies (including suppliers) with good performance and conducted an online vote among its readers, asking them to vote for the top 10 most popular companies in 2021. The voting results show that BYD, Tesla, CATL, Xiaopeng, NIO and other new energy vehicle brands have gained more support and affection from netizens. In addition, some emerging enterprises have also begun to attract netizens' attention, such as Xiaomi, neta and so on.

Founded in 2003 as the leading enterprise of new energy vehicles in the United States, Tesla is mainly engaged in the design, manufacturing, and sales of pure electric vehicles. Tesla electric vehicles meet the highest standards in the automotive industry in terms of quality, safety, and performance, and provide services such as over-the-air OTA upgrade and complete charging solutions. Reducing global transportation dependence on non-renewable energy sources.

Established in 1995 as a leading enterprise of new energy vehicles in China, BYD has business spanning four major industries: automobile, rail transit, new energy, and electronics. In 2003, it grew into the world's second largest

rechargeable battery manufacturer and established BYD in the same year. According to the official website of BYD, the product layout of BYD's new energy vehicles mainly includes two series and three models. Among them, the product layout of the Dynasty family series is more, including the three models of SUV, sedan and MPV. It can be seen that the Dynasty family series is currently the main new energy vehicle plate of BYD.

B. A Study on New Energy Vehicle Emerging Enterprises

After several years of competition in the new energy vehicle market, among the emerging new energy vehicle enterprises, NIO is the LEADING one, Xiaopeng, LEADING IDEAL and Hicar are the most concerned ones by investors and consumers.

NIO, an intelligent electric vehicle brand, was registered and established in Shanghai in 2014 to participate in global competition on behalf of domestic high-end electric vehicles. In 2021, NIO released its flagship sedan ET5 based on a new platform and an intermediate sedan directly against Tesla Model 3. Of course, NIO has also made some achievements internationally: in 2021, NIO entered the Norwegian market for the first time, marking the first year of its globalization.

As a leading private high-tech enterprise in China, HUAWEI has China's top technical team in radio, microelectronics, and communication. HUAWEI announced its entry into the new-energy vehicle industry at the end of 2021, but it chose not to build "complete vehicles". Instead, it positioned incremental components suppliers of intelligent vehicles by focusing on ICT technology, providing high-tech technologies that traditional vehicles do not have: Including high-precision maps, chips, sensing hardware (lidar, etc.), intelligent cockpit, intelligent driving, ecological services, cloud, etc.

On December 23, 2021, AITO officially launched its first intelligent luxury electric drive SUV model AITO M5, which is the first commercial smart car with HUAWEI Harmony OS smart cockpit. Since its official delivery on March 5, 2022, the total delivery of 11,296 units, priced between 2598 yuan and 331,800 yuan, has reached 87 days since its official launch, attracting the attention of many investors.

C. Comparative Analysis of Different Enterprises

The comparison of different companies can be divided into three dimensions: First, comparison of core technology and differentiated competitiveness; second, sales volume and market share comparison; third, investment direction and future trend.

Dimension of comparison	Tesla	BYD	NIO
Density of battery	300wh/kg	180wh/kg	150-360wh/kg
Endurance Mileage	536-675km	305-420 km	355-425km
Battery price	17000CNY	12000CNY	/
Security level	High	High	Low
Core control and battery pack matching	High	High	Low
Charging mode	Household and public charging pile	Household and public charging pile	Household, public charging pile, power exchange station, mobile charging car

Fig. 3. Comparison of battery technologies for new energy vehicles.

The core technology of new energy vehicles is battery system, transmission system and electric control system. By comparing the battery quality of Tesla, BYD and NIO, it is found that the battery technology of Tesla and BYD is significantly better than that of NIO (Fig. 3).

In terms of new energy vehicle batteries, NIO has no core technology and mainly relies on suppliers. However, the arrangement of battery pack is carried out by NIO, but the core control and battery pack cannot be well balanced, and the conversion rate is low. Not only that, but also because the unreasonable wiring harness arrangement led to several spontaneous combustion events, the level is not high.

BYD's chips, batteries, drivetrain, and electric control technologies are all developed independently. Compared with NIO, its batteries are more durable and cheaper. BYD also avoids the problem of low core control and battery pack compatibility because there are not too many suppliers involved, and its conversion rate is much higher than that of NIO. In terms of quality control, NIO models are processed by JAC, while BYD has its own production line, to achieve better quality supervision.

Tesla, as a giant of new energy vehicles, has one of its core technologies in electronic control. With the BMS electronic control technology carried by Tesla, each battery can intelligently control 18,650 batteries to achieve the highest efficiency in terms of charging and endurance, etc. Although BYD's electronic control technology is also developed by itself, it still lags behind BYD in the field of electronic control technology.

Tesla, however, chose to use Panasonic's three-way lithium-ion battery technology rather than develop it itself. After 2020, BYD has successfully developed blade batteries with superior performance, reduced battery costs and improved energy storage density. Research shows that BYD endurance is better under the same environment.

NIO's unique selling point is that it adds a new charging method, replacing charging piles with rechargeable battery packs, resulting in a fundamental shift in infrastructure and future business models.

Finally, NIO cars have differentiated competitiveness. It aims to provide a comprehensive "car service" including charging, maintenance, insurance and daily services, and the communication will be done through an App. These services have attracted consumers to buy NIO vehicles and have also opened and led a new field for the service system of the new energy vehicle industry.

According to the latest production and sales data, in 2021, China's auto production and sales completed 26.082 million and 26.275 million, respectively, with year-on-year growth of 3.4% and 3.8%. In 2021, China's auto sales ended three consecutive declines and finally began to grow positively.

Among them, the rise of the new energy vehicle market is the main reason for China's automobile industry to end the three-year decline. In 2021, the sales of new energy vehicles in China reached 3.521 million units, a year-on-year increase of 1.6 times, ranking the first in the world for seven consecutive years. Among them, the sales volume of new-energy passenger vehicles was 3.334 million, up 167.5% year on year.

According to the data in Fig. 4, the sales volume of new energy vehicles in 2021 will account for 13.5%. Although the percentage is small, the growth trend is significant, with new energy growing by 167% in 2021.

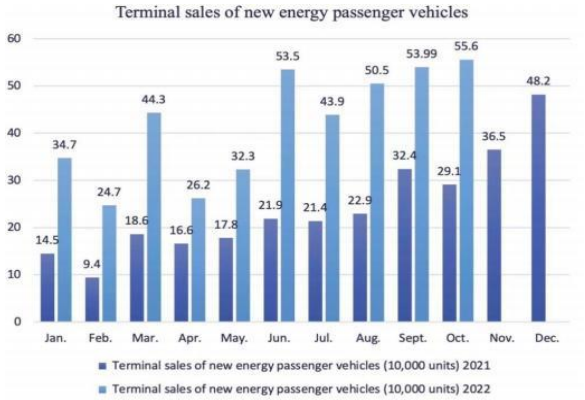

Fig. 4. Terminal sales of new energy passenger vehicles.

According to the retail sales data in Fig. 5 of the Federation in the first quarter of 2022, the cumulative sales volume from January to March was 4.915 million, down 4.5% year-on-year. Among them, the cumulative sales volume of new energy vehicles from January to March 2022 was one million, with a year-on-year growth of 136%. Sales from April to October showed a super-fast growth trend. In October 2022, the annual cumulative sales volume of new energy vehicles has reached 4,196,900, far exceeding the total sales volume of 2021 (2,893,000).

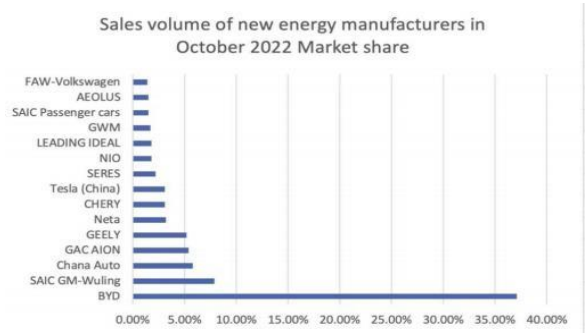

Fig. 5. Sales volume of new energy manufactures in October 2022 Market share.

In October 2022, BYD had a 37.1% share of the new energy market, with Chana Auto and GEELY holding 7.9% and 5.8%, respectively. Tesla, the US leader in new energy, ranked eighth with a 3.1% market share. NIO, which is followed by many investors, accounted for 1.8% of the total market with 10,059 units, up 174.3 per cent from 3,667 units in October 2021. These data show that the new energy vehicle market is developing at a very fast speed. While there are many investment vents, the competition is also fiercer.

It is a trend of the development of the new energy industry to combine the automobile industry with emerging technologies such as artificial intelligence and big data to achieve the goal of intelligent driving. Enterprises that take intelligent driving as the main business direction will have a good development space and increase revenue, including hardware enterprises that provide equipment, and enterprises that provide data and software or services to realize intelligent operation.

Traditional cars will upgrade to light weight, energy saving and other directions. Because this can improve the power of the car, reduce fuel consumption, reduce exhaust pollution. Only with the goal of sustainable development can enterprises maintain or increase their market share in the highly competitive automobile market.

V. Method

A. Theoretical Hypothesis

Through literature review and social practice, there are the following guesses about the stock of new energy vehicles:

First, as China is still a developing country to steadily develop its domestic economy, its GDP growth will actively promote the growth of national consumption demand, and the growth of consumer demand is bound to lead to the growth of Consumer Price Index (CPI). As a kind of traded commodity, the growth of new energy vehicle stock is positively correlated with the growth of CPI.

Second, the exchange rate, as the exchange rate between the two currencies, affects the price of imported goods sold in the country. When the exchange rate declines, the price of imported goods in the country will rise, and the sales volume will decrease accordingly. It also shows up in the stock market in the form of falling stock prices.

Third, with the rapid development of new energy vehicles into the golden period, the revenue and profit of various automobile enterprises will get different degrees of growth. Among them, the growth of profits and the growth of stock prices show a positive correlation.

B. Introduction of Experimental Methods and Data Acquisition

In the field of data statistics and analysis, linear regression is one of the mainstream statistical analysis models. The unitary linear regression model can explain the change of the dependent variable through one of the most important influencing factors as the independent variable, but for the stock price of new energy vehicles, its change is often affected by several important factors. Therefore, it is necessary to use two or more influential factors as independent variables to explain the changes of dependent variables. Statistical Product Service Solutions (SPSS), as a statistical based software for analysis and operation, data mining, predictive analysis, and decision-making, has been maturely applied in various fields of natural science, technical science, and social science. Famous newspapers and magazines have been using SPSS for in-depth data analysis, and its accuracy has been verified.

Among them, this paper selected China CPI (Consumer Price Index), Exchange rate (USD-CNY) and Tesla (China), BYD and NIO's net sales in the Chinese market as independent variables, and stock prices of these three companies as dependent variables for multiple linear regression analysis.

In view of the changes in the stock prices of new energy vehicles, this paper collected the stock prices of Tesla, BYD and NIO from Yingwei's financial situation， a Chinese brand of Investing.com, the fourth largest financial website in the world.

From January 2021 to October 2022, Tesla (Stock symbol: TSLA), an American new energy vehicle company listed in NASDAQ, NIO (stock symbol: NIO), a Chinese new energy vehicle company listed in New York, and BYD (Stock symbol:002594), a Chinese new energy vehicle company listed in Shenzhen, China, were tracked for half a year. In addition, Exchange rate (USD/CNY) data was collected on the same website. Data were collected on the official website

of the National Bureau of Statistics of China for the CPI index released by the bureau from 2021 to 2022. Aiming at the monthly net profit performance of Tesla, BYD and NIO in the Chinese market, the data of the quarterly financial reports published on the official website of each company were sorted out and recorded.

VI. Analysis of Results

According to the linear regression data (Tables I–III) of SPSS software, Tesla, BYD and NIO have the following responses to China CPI, Exchange rate (USD-CNY) and net profit of each company.

TABLE I: Tesla SPSS Linear Regression Analysis Results

Influencing factors	BETA
China CPI	0.639
Exchange rate (USD-CNY)	- 1.098
Tesla net profit	0.497

TABLE II: BYD SPSS Linear Regression Analysis Results

Influencing factors	BETA
China CPI	1.055
Exchange rate (USD-CNY)	-0.602
BYD net profit	0.001

TABLE III: NIO SPSS Linear Regression Analysis Results

Influencing factors	BETA
China CPI	0.485
Exchange rate (USD-CNY)	0.204
NIO net profit	1.449

A. The Impact of CPI on Stock Price

The BETA coefficients of Tesla, BYD and NIO are all greater than 0 in China CPI. This proves that with the rise of CPI, the commodity price will increase with the commoditization of stocks as an investment area for investors, regardless of the change in the value of the commodity itself. As a result, the share prices of all three companies have risen. The figure was in line with expectations.

The BETA coefficient of BYD, Tesla and NIO are 1.055, 0.639 and 0.485 respectively. BYD has the largest BETA coefficient, Tesla has the second largest BETA coefficient and NIO has the smallest BETA coefficient. This reflects that the prices of the new energy vehicle products of Tesla, BYD and NIO have increased to different degrees along with the growth of inflation, except for the factors of stock price increase caused by the increase of average price level. In the new-energy vehicle market, consumers need to pay more for the same model of car compared to before inflation.

Moreover, the value of a company's stock is closely related to the company's own operating conditions. Based on the BETA coefficient of BYD is greater than 1 and that of NIO and Tesla is less than 1, it can be concluded that the operating conditions of BYD company are better than those of Tesla and NIO to some extent. On the other hand, as a leader in the emerging new energy enterprise industry, NIO's BETA coefficient is 75.90% of Tesla's BETA coefficient, which reflects that NIO is gradually catching up with the development speed of top new energy automobile enterprises and has great potential for future development.

Finally, BETA index can also reflect consumers' purchase preference for new energy vehicles. When prices rise, consumers' income will also increase, which will stimulate consumers' desire to buy. The BETA coefficient of BYD is greater than 1, which proves that when the income of consumers with car demand increases, compared with Tesla and NIO, they will preferentially choose to buy BYD's new energy vehicles. Because the average selling price of BYD cars is lower than that of Tesla and NIO, it provides cars with independently developed core technologies to provide customers with good driving experience, reflecting a very high-cost performance. As for Tesla and NIO, both target the high-end market, with an average price of 400,000 new energy vehicles against BMW, Mercedes-Benz, Audi and other traditional car manufacturers selling medium and high-end cars. As a result, some customers who are willing to buy new energy vehicles are unable to buy Tesla and NIO products due to the high price. As the BETA coefficient of Tesla is higher than the BETA 0.154 of NIO, it can be concluded that consumers' purchase intention for Tesla is greater than that for NIO. This may be because Tesla is far superior to NIO in mastering core technologies and deploying strategies.

B. The Impact of Exchange Rate on Stock Price

The BETA coefficient of Tesla and BYD is less than 0 at the Exchange rate (USD-CNY). This reflects that when the RMB depreciates, the most direct impact on BYD and Tesla is that the stock of these two companies will fall. The BETA coefficient of NIO is greater than 0 at the Exchange rate (USD-CNY). This reflects that when RMB depreciates, the most direct impact on NIO is that its stock will rise.

For investors who invest in the stock market for profit, the depreciation of RMB will generally reduce their confidence in investing in China's new energy vehicle market. In the short term, the depreciation of RMB will prompt consumers to purchase foreign exchange reserves as soon as possible, thus guaranteeing the original value of personal assets. In the long run, investors will choose to invest RMB in the stock market or buy government bonds to offset the asset losses caused by the depreciation of RMB.

The BETA coefficient of Tesla is −1.098. In the case of a weaker yuan, imported car companies will set higher prices in China to maintain their revenues. The increased price will reduce consumers' purchase demand, leading to an obvious decline in the income of the imported new energy industry in China. Eventually, investors will show a bearish trend for the stocks of the imported new energy industry, and less capital will pour into the imported new energy vehicle market. This is consistent with the proposed theoretical hypothesis.

The BETA coefficient of NIO is 0.485, much higher than that of Tesla (−1.098). It can be found that the depreciation of RMB may be good news for NIO cars. Because both NIO Auto and Tesla Auto are positioned as high-end new energy vehicles in China, the customer portraits they face are very similar. When Tesla increases the price due to the depreciation of RMB, some users who are eager to buy high-end new energy vehicles will choose to buy NIO cars as substitutes for Tesla cars. As a result, NIO's market share and

revenue will increase. When NIO's profits rise, so does NIO's share price.

The BETA of BYD is −0.602, which is larger than that of Tesla (−1.098) and smaller than that of NIO (0.485). It can be found that when RMB is depreciated, the stock price of BYD also suffers a decline to a certain extent. This does not accord with the previously proposed theoretical hypothesis.

C. The Impact of the Company's Net Profit on Stock Price

The BETA coefficients of Tesla, BYD and NIO are all greater than 0 in terms of their net profit. This shows that when the net profit of the enterprise increases, the stock of the enterprise is subject to varying degrees of rise. This also supports the hypothesis.

Among them, the BETA coefficient of NIO is 1.449, much higher than that of Tesla and BYD. This suggests that for every percentage point increase in profits, share prices tend to rise in a very positive fashion. This also confirms the fact that NIO, as a start-up company, has received high attention in the investment industry as many well-known groups have invested in NIO. Not only that, but NIO's excellent marketing and publicity will also attract individual investors to invest in NIO's stock, leading to a rise in the stock price.

The BETA coefficient of Tesla ranks the second place with 0.497, which indicates that Tesla is an old American new energy vehicle company. Offering high- quality new energy vehicles to the market in an innovative way can still increase stock prices in a highly profitable way. At present, the stock of Tesla at home and abroad has maintained a bullish trend. Investors may also choose to hold Tesla's stock for the long term in search of a huge gain.

BYD has a BETA coefficient of 0.001. This suggests that net profit has little impact on BYD's share price. This may be because BYD is unwilling to increase the stock price by hyping up the stock of BYD, and in its market strategy, it is unwilling to push up the stock price of BYD with large funds.

VII. Conclusion

Through the analysis of multiple linear regression data, it can be seen that CPI has the following two influences on the market: First, when stocks are commodity attributes, they will rise with inflation; Second, the overall operation of BYD is better than that of Tesla and NIO, which indirectly encourages consumers to buy BYD's products most actively when their incomes rise. The Exchange rate (USD-CNY) has different influences on Chinese new energy vehicle brands and foreign new energy vehicle brands in China's new energy vehicle market. When the exchange rate goes down, the market income of imported new energy vehicles will be significantly hit, but as a substitute, the sales volume of China's local new energy vehicle market will be increased. Finally, the company's net profit shows a positive correlation with the company's stock price. Compared with the old new energy vehicle companies, investors are more optimistic about the future prospects of the emerging new energy vehicle companies and are willing to invest in the emerging companies.

As the leader of imported new energy vehicle companies, Tesla is still strong in sales volume and investors' confidence in Tesla despite some negative news. But Tesla is more affected by the volatility of its profits. For China's more mature new-energy vehicle companies, technology and sales are growing steadily, and in the future, net profit will also grow geometrically. For China's emerging new energy vehicle companies, the opportunity to develop homegrown new energy vehicles has arrived. For example, NIO, with its unique after-sales service, multi-directional marketing and strong capital investment, will enjoy increasing market acceptance.

However, there are still bottlenecks in the core technology research and development of new energy vehicles and there is still a shortage of sophisticated technology research and development personnel. The deployment of car charging piles in China's second- and third-tier cities still has a big gap. These two points lead to the current market is still a part of the population for the safety and convenience of new energy vehicles are still skeptical. In addition, the pricing of some models is still expensive, which inhibits the consumption of some groups who are willing to buy new energy vehicles.

In order to develop China's local NEV industry, the government needs to implement the following measures:

First, reduce corporate income tax for Chinese new energy vehicle companies and their supporting industries. This policy encourages China's new energy vehicle companies to earn more net profits while the turnover remains the same. Enterprises will have more funds to invest in the research and development and promotion of new products, and finally enrich the product types of new energy vehicles in the market to meet the needs of different groups of people.

Second, for domestic new energy vehicles based on more financial subsidies. This policy encourages China's new energy industry to cultivate more powerful Chinese independent innovation technologies for new energy vehicles and gives technical talents generous salaries to motivate them to contribute to the development of cutting-edge technologies for new energy vehicles. This will accelerate the implementation of the core technology of the concept vehicle as soon as possible, and the possibility of mass production of innovative products, so as to truly meet consumers' expectations. At the same time, the policy also provides consumers who are willing to buy domestic new-energy vehicles with the possibility of buying the same new-energy vehicle at a lower price. This has improved the cost performance of new energy vehicles and promoted more consumers to buy domestic new energy vehicles.

Conflict of Interest

The author declares no conflict of interest.

References

Abirami, R., & Vijaya, M. S. 2012. Stock price prediction using support vector regression. ***Global Trends in Computing and Communication Systems,*** 269: 588–597.

Andrew, L., & Malik, A. M. A. (2014). Information technology and competitive advantages among small and medium enterprises in Malaysian tourism industry. ***Proceedings of the 1st AAGBS international conference on business management 2014 (AiCoBM 2014)***. doi: 10.1007/978-981-287-426-9_37

Box, G. E. P., & Jenkins, G. M. 1990. Time series analysis: Forecasting and control. ***Journal of Time,*** 31(4): 238–242.

Gao, Y., & Shang, Y. 2017. Analysis on the competitiveness of Chinese high-speed rail Industry investment in Central and Eastern European

countries based on the modified diamond model. ***Guangdong Social Sciences,*** (1): 29–30.

Hasishi, I. 2007. Overview of Japan's efforts on plug-in hybrid vehicle. ***EVS-23 plug-in hybrid electric vehicle workshop,*** California USA, 35: 235–240.

Huang, W., Nakamori, Y., & Wang, S Y. 2005. Forecasting stock market movement direction with support vector machine. ***Computers & Operations Research,*** 32(10): 2513–2522

Jin, B. 1996. Study on international competitiveness of industry. ***Economic Research,*** 1996(11): 39–40.

Krupa, J. S., Rizzo, D. M., Eppstein, M. J., *et al.* 2014. Analysis of a consumer survey on plug-in hybrid. ***Transportation Research Part A: Policy and Practice,*** 64: 14–31.

Lee, J. W. 1996. Government interventions and productivity growth. ***Journal of Economic,*** 1(3): 391–414.

Lichtenberg, F. 1987. The effect of government funding on private industrial research and development: A Reassessment. ***The Journal of Industrial Economics,*** 36: 97–104.

Liu, Y. Q, & Kokko, A. 2013. Who does what in China's new energy vehicle industry? ***Energy Policy,*** 57: 21–29.

Li, X., & Jia, H. 2013. Break-even analysis on the charging and battery-swapped station of electric vehicles. ***Journal of Power & Energy Engineering,*** 1(1): 1–5.

Morrow, K., Karmer, D., & Francfort, J. 2008. Plug-in hybrid electric vehicle charging infrastructure review. ***Electric Vehicles,*** INL/EXT-08-15058.

Oltra, V., & Jean, S. M. 2009. Variety of Technological Trajectories in Low Emission Vehicles (LEVs): A Patent Data Analysis. ***Journal of Cleaner Production,*** 17(02): 201–213.

Pai, P. F., & Lin, C. S. 2005. A hybrid ARIMA and support vector machines model in stock price forecasting. ***Omega,*** 33(6): 497–505.

Phua, P. K. H., Zhu, X., & Koh, C. H. 2003. Forecasting stock index increments using neural networks with trust region methods. ***Proceedings of the international joint conference on neural networks,*** 260–265.

Polk, C., & Sapienza, P. 2004. The real effects of investor sentiment. ***SSRN Electronic Journal,*** 22.

Porter, M. E. 1900. ***Competitive advantage of nations.*** New York: The Free Press.

Sitenecker, A. 2005. ***An ultracapacitor-battery energy shortage system for hybrid electric vehicles*****.** The University of Toledo ProQuest Dissertations Publishing, 3197544.

Su, F. 2010. The concept and realization way of low-carbon transportation. ***Integrated Transportation,*** 2010(5): 13–17.

Warwick, K. 2013. Beyond industrial policy: Emerging issues and new trends. ***OECD Science, Technology and Industry Policy Papers,*** 2.

Wan, Z., Spring, D., & Wang, Y. S. 2015. China's electric car frustrations. ***Transportation Research Part D: Transport and Environment,*** 34: 116–121.

Wynne, J. Impact of plug-in hybrid electric vehicles on Califonia's electricity grid. ***Plug-in Hybrid Electric Vehicles,*** 2009.

Yang, Y. ***Research on multi-level development of new energy based on automobile industry.*** Dissertation, Beijing: China University of Geosciences (Beijing), 2011.

Zeng, Y., & Shi, Z. 2011. Comparative analysis of Domestic and foreign new energy vehicle industry policies. ***Enterprise Economics,*** 2: 107–109.

Zhang, X., Fuehres, H., Gloor, P. A., *et al*. 2011. Predicting stock market indicators through twitter "I hope it is not as bad as I fear". ***Procedia - Social and Behavioral Sciences,*** 26: 55–62.

Zhang, Y., Chu, G., & Shen, D. 2020. The role of investor attention in predicting stock prices: The long short-term memory networks perspective. ***Finance Research Letters,*** 38: 1544–6123.